If you are using a printed copy of this procedure, and not the on-screen version, then you MUST make sure the dates at the bottom of the printed copy and the on-screen version match.
The on-screen version of the Collider-Accelerator Department Procedure is the Official Version.
Hard copies of all signed, official, C-A Operating Procedures are kept on file in the C-A ESHQ Training Office, Bldg. 911A.

C-A OPERATIONS PROCEDURES MANUAL

1.10.2 Environmental Management Program Description

Text Pages 2 through 13

Attachments

Hand Processed Changes

HPC No.	Date	Page Nos.	Initials

Approved: ***Signature on File*** _____
Collider-Accelerator Department Chairman Date

M. Van Essendelft

1.10.2 Environmental Management Program Description

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Attachment 1.10.2.a: Collider-Accelerator Organization Chart
Attachment 1.10.2.b: Collider-Accelerator EMS Contacts and Responsibilities
Attachment 1.10.2.c: Collider-Accelerator EMS Document Flow-down Matrix

1.0 Description of the Collider Accelerator Department

1.1 Mission

In support of Brookhaven National Laboratory's broad mission of providing excellent science and advanced technology in a safe, environmentally responsible manner, the Collider Accelerator (C-A) Department is committed to the following:

- ❖ Excellence in environmental responsibility and safety in all C-A Department operations.
- ❖ The development, improvement, and operation of the suite of proton/heavy ion accelerators used to carry out the program of accelerator-based experiments at BNL.
- ❖ The support of the experimental program including design, construction, and operation of the beam transports to the experiments and partial support of detector and research needs in the experiments.
- ❖ The design and construction of new accelerator facilities in support of the BNL and National Missions.

1.2 Facility Description

At this time, the C-A Department has a nuclear physics program, the focus of which is the Relativistic Heavy Ion Collider (RHIC) that operates to study nuclear phenomena in heavy ion collisions. The Collider and experimental facilities are the terminus of a complex of other existing accelerators and beam transfer equipment. A high-energy physics program to look for physics beyond the Standard Model is conducted at the AGS. In the area of health effects, heavy ions of the type encountered in space travel are also studied at AGS.

The operational complex is made up of the Tandem Van De Graaff, the Linac, the Booster synchrotron, the AGS, and the RHIC. Two major experimental areas extend off the AGS: the slow-extracted-beam (SEB) experimental area, and the fast-extracted-beam (FEB) experimental area. The RHIC has four major RHIC experimental areas: PHENIX, PHOBOS, STAR and BRAHMS.

The Linac is a linear accelerator and it accelerates H^- ions to 200 MeV. The BNL Medical Department uses most of the Linac beam in its Brookhaven Linac Isotopes Producer (BLIP) for the production of radiopharmaceuticals. A small fraction of the total Linac beam is sent to the Booster synchrotron. At the Booster, electrons are stripped off and the proton beam is accelerated to about 1.9 GeV. It is injected into the AGS where acceleration up to 30 GeV occurs. At this time, the output from AGS is $6x10^{13}$ protons every 2 to 3 seconds at 24 GeV. The proton output is sent to the SEB and FEB experimental areas.

The AGS accelerates heavy ions at the intensity of about 10^{11} nucleons every 3 seconds. The ions reaching the AGS start at the Tandem van De Graaff where they reach about 1 MeV per nucleon. These heavy ions are injected into the Booster synchrotron, and then AGS. The final heavy-ion energy is about 11 GeV per nucleon for Au ions.

At this time, five slow-extracted-beam targets and one fast-extracted-beam target each receive from $5x10^{18}$ to $5x10^{19}$ protons y^{-1} at 24 GeV from AGS. The BLIP uses $3x10^{21}$ protons y^{-1} at 200 MeV. The RHIC is designed to have a Au ion population of 2.3×10^{11} ions or a proton population of $2.3x10^{13}$ protons, which is to be re-filled every 10 hours.

Beams are transported through many hundreds of meters of tunnel and accelerators. This transport system is shielded with up to 7-m thick earth-roofs and 20-m thick earth-sides. Most accelerated particles end at targets inside heavily shielded target-caves with 3-m thick high-density-concrete walls.

The target cave is the terminus of the primary beam transport at AGS facilities. About half the proton beam interacts in a target, with the remainder going to the next target downstream or directly to a beam stop. Target caves are located in a large 5-acre building in the SEB experimental area. Beam is transported through a series of magnets providing control of the size of the beam and the beam direction. Beam interactions, remote from the production target, are minimized by confining the beam to a pipe evacuated of air. This beam pipe runs the entire length of the accelerator complex, through magnets and beam-line equipment.

Target caves are constructed of heavy concrete and steel shielding with labyrinthine entry passages, with elaborate security circuitry and procedures to prevent personal exposure.

The target areas in FEB are external to buildings. Roof structures over target caves are designed to shed rainwater to the paved areas that surround the experimental areas. The rainwater flows to storm sewers located in paved areas and then into the recharge basin.

The RHIC Complex is a 2.5-mile circumference particle collider located in the north central portion of BNL. The RHIC utilizes superconducting magnets to bend and focus the beam. The magnets are cooled to 4.6K supercritical helium gas. At cryogenic temperature, the magnets acquire superconducting properties, thereby greatly reducing the amount of electricity that must be supplied to generate the magnetic field. Accelerated particles from counter rotating beams in separate rings are then steered into collision within a detector system. The detectors analyze and categorize the secondary particles resulting from the collision. Two major detector facilities, STAR and PHENIX, have been constructed at the 6 and 8 o'clock locations, respectively. Smaller "AGS class" experiments have been installed at the 2 and 10 o'clock locations. The 4 and 12 o'clock locations remain for future development. The Collider beam stops are located in the Collider tunnel on either side of the 10 o'clock region.

The C-A Department, through funding from the National Aeronautics and Space Administration, has constructed the NASA Space Radiation Laboratory (previously

called the Booster Applications Facility, BAF). The NASA Space Radiation Laboratory is a national facility for research in the diverse field of biological effects of high-proton number, high-energy particles. The facility is capable of answering the most basic question in this field, which is quantifying the risk to humans in different shielding environments from exposure to ionizing particles in galactic cosmic rays.

The NASA Space Radiation Laboratory (NSRL) is essentially an extraction system in the Booster ring followed by a beam line, target area and beam stop, with adjacent experimental and utility support buildings. With regard to environmental impacts at NSRL, the effluent hazards include generation of H^3 and Na^{22} in the earth shielding, which could potentially contaminate the ground water, and generation of short-lived radioactive gases in the air in the tunnel and Target Room. Both of these have been addressed and the associated hazards have been eliminated or controlled by design. Even though tritium levels in cooling water are less than the Drinking Water Standard, the intent of Suffolk County Article 12 Code was followed in the design of cooling water systems and piping that contain trace amounts of tritium.

In the operation and maintenance of the Collider-Accelerator facilities there are activities that can impact the environment. The Collider-Accelerator Department, along with all other Lab-wide organizations, has implemented a program that places safety and environmental responsibility in the forefront of all its activities. The environmental portion of this program, detailed below, captures the intent of ISO 14001 and conforms to Brookhaven National Laboratory's ISO 14001 "Plus" Environmental Management System Manual.

2.0 Significant Aspects

To provide excellent science and advanced technology in a safe and environmentally responsible manner the Collider-Accelerator has, over the past decade, continuously reviewed the aspects of its operations in an effort to identify and accomplish waste minimization and pollution prevention opportunities. This process began in 1988 with the development of Formal Environmental Design Guides and a Design Review Process. More recently, this effort has resulted in a further formalization of its processes under the guidelines of ISO 14001, the BNL ISO14001 "Plus" Environmental Management System Manual, and SBMS subject areas governing ISO 14001 implementation.

Based on the aspect identification and analysis process in the Subject Area, Identification of Significant Environmental Aspects and Impacts, the following aspects are significant to the Collider Accelerator Department activities:

- Regulated Industrial Waste
- Hazardous Waste
- Radioactive Waste
- Mixed Waste
- Atmospheric Discharge
- Liquid Effluents

- ❖ Storage/Use Of Chemicals or Radioactive Material
- ❖ Soil Activation
- ❖ PCB's
- ❖ Water Consumption
- ❖ Power Consumption
- ❖ Environmental Noise

3.0 Collider-Accelerator EMS Implementation Plan

3.1 General Requirements

The Implementation Plan, as listed below, describes the C-A Department's establishment and maintenance of an EMS program as prescribed by ISO 14001.

3.2 Environmental Policy

The environmental policy as set forth by Brookhaven National Laboratory in the Environmental Stewardship Policy is the foundation on which the C-A Department EMS program is established. The communication of this policy is accomplished as outlined in the BNL ISO 14001 "Plus" Environmental Management System Manual. The C-A-OPM 1.10, C-A Environmental, Safety and Health Policy, ensures implementation of the Environmental Stewardship Policy through formal Collider Accelerator Department ESH programs.

3.3 Planning

3.3.1 Environmental Aspects and Impacts

The C-A Department is committed to identifying its environmental aspects during the planning phase of its operations. This is accomplished through implementation of the following operational procedures: C-A-OPM 2.28, C-A Procedure for Work Planning and Control of Operations; C-A-OPM 2.29, C-A Procedure for Enhanced Work Planning for Experimenters; C-A-OPM 9.1.12, Review of C-A Shielding Design; C-A-OPM 9.1.15, Guideline for Radiation Review Criteria for C-A Experiments; C-A-OPM 9.2.1, Reviewing Environmental, Health, and Safety Aspects of an Experiment; and C-A-OPM 9.3.1, Reviewing Conventional Safety Aspects of an Accelerator System. On an annual basis, or as determined by the C-A EMS Management Representative, aspects that are identified through planning and reviews shall be documented through the implementation of the BNL SBMS Subject Area - Identification of Significant Environmental Aspects and Impacts.

The Facility Review Project and The Phase II Process Evaluations have served as the technical baseline through which the aspects have been identified. The Phase II Process evaluations will be reviewed and updated annually or as required by significant process change. Evidence of review will either be actual procedure revision by the process owner or a memo on file (in the current Environmental

Program Support File) stating that the procedure has been reviewed and there are no revisions required. Verification of this annual review will be accomplished as a normal part of the C-A assessment process or as part of the internal EMS audit process. Concurrent with these assessments will be a review of the aspects analysis and an update of the C-A Department's significant aspects. Records of the aspects analysis are maintained in the Environmental Program Support File, which can be found in the office of the Environmental Management System Representative, or his delegate. A list of the significant aspects related to the C-A activities is as found in section 2.0 of this document.

3.3.2 System for Determining Legal and Other Requirements

Various institutional-level Subject Areas have been developed to identify legal and other requirements. The C-A Department has three primary means of access to these requirements. First, the C-A Department actively participates in Subject Area development to assure that Laboratory and Department goals are achieved and are in accordance with all applicable requirements. Secondly, the SBMS Subscription Service is used by the C-A ESHQ staff for notification of changes to Laboratory documents. Lastly, the department routinely utilizes its Environmental Compliance Representative and the Environmental Compliance Subject Matter experts in the evaluation and determination of legal and other requirements on existing work and future review of experiments to be held within the complex.

3.3.3 System for Defining Objectives and Targets

C-A Department objectives and targets are documented using several formal methods within the Collider-Accelerator Department. The Environmental Management Program Forms are used in accordance with the Subject Area, Identification of Significant Environmental Aspects and Impacts and are the primary mechanism in identifying objectives and targets. Responsibility for achieving the goals of this action plan are documented and assigned to cognizant individuals throughout the Department. Objectives and targets are developed as a result of BNL Contract requirements, governmental regulatory requirements, changes in the BNL Critical Outcomes/ Objectives/ Performance Measures, the Environmental Services Division's Lab-level Environmental Objectives with Suggested Targets, and C-A Management Reviews of the EMS Program. These requirements are documented in the C-A EMS program documents and in the C-A Self Assessment Plan that are developed annually. Additional objectives and targets may result from C-A Management Reviews of the EMS Program. Due to the nature and scope of Collider-Accelerator Department operations, in addition to other objectives, there are two ongoing objectives found in the EMS Program. The first objective is the prevention of groundwater contamination from activated soils. The second objective is the reduction of legacy materials that have been produced by various experiments and facilities. The C-A Objective and Targets may be listed in the following three areas: the Environmental Management Programs, the Self Assessment Plan or as an appendix attached to this document.

3.3.4 Environmental Management Programs

The C-A Environmental Management Program is assured through a documented program of safety reviews and work planning. The C-A Environmental Compliance Representative serves on both the Experimental Safety Review Committee (ESRC) and the Accelerator Systems Safety Review Committee (ASSRC) and is the focal point for documenting environmental issues for inclusion in the C-A Environmental Management Program. All EMS issues identified as part of ESRC and ASSRC reviews are documented as part of the normal operations of the committees. It is the responsibility of the ECR to review activities brought before the committees for implementation of environmental controls and to add or revise C-A Environmental Aspects as required to accomplish the integration. Identified EMS action items are then incorporated, as appropriate, through the work planning process documented in and , or closed out in the experiment or accelerator-modification approval process documented in C-A-OPM 2.28 and C-A-OPM 2.29, or closed out in the experiment or accelerator-modification approval process documented in C-A-OPM 9.2.1 and C-A-OPM 9.3.1.

In addition to these controls there are specific tasks listed within Section 10 of the Environmental Management Program form, which are derived from the departments objectives and targets. These tasks are a result of the processes as described in Section 3.3 of this document but tasks may be added as a result of the safety reviews and work planning.

3.4 Implementation and Operation

3.4.1 Structure and Responsibility

The C-A Department functional relationships and responsibilities for EMS are outlined in C-A OPM 13.1.1, Quality and Environmental Management System. The C-A Department Chairman is responsible for implementation of EMS within the C-A Department and appoints an EMS Management Representative (ESHQ Associate Chair) to ensure that the EMS system requirements are established, implemented and maintained. Other specific EMS roles and responsibilities are further defined through Roles, Responsibilities, Accountabilities and Authorities (R2A2's) documents generated for each member of the C-A Department.

3.4.2 Training, Awareness, and Competence

The training program within the C-A Department is as outline in C-A-OPM 1.12, Conduct of Training Policy. Formal training and qualification programs for the operation of equipment, processes and procedures that could have a significant impact on the environment are documented. Job specific training is developed for environmental processes that involve significant aspects. Employees that have interaction in these processes are required to go through training.

Contractors, suppliers, and users fall under the C-A EMS training requirements when it is determined that their work within the facility could cause a significant impact to the environment. Competency requirements are specified and can be attained through testing or the read and acknowledgement form.

Specific Environmental Training, within the C-A Department, consists of the following:

- All C-A employees are given the facility specific Introduction to C-A EMS.
- All C-A employees complete the web based GE-ENV-GET, Environmental Protection for General Employees.
- Job specific training has been developed for environmental processes that involve significant aspects. This training addresses process-specific conformance, environmental impacts, benefits of improved performance, each person's role and responsibility, the consequences of nonconformance and the appropriate actions to be taken.
- Users are introduced to C-A EMS in Users Training programs.

3.4.3 Communication

Internal communication of significant aspects and EMS strategies require mechanisms for information to flow from top-down and bottom-up. The primary means for this communication within the C-A Department occurs through a schedule of weekly planning meetings. During these structured meetings, involving appropriate personnel, work is planned and evaluated, concerns of safety, equipment, hazards, and environment are addressed, and resources are allocated. A table and flow diagrams of weekly meetings can be found in C-A-OPM-ATT 2.28.a.

Various Groups within the C-A Department communicate EMS information through their group's Web page. Access to technical and non-technical information from these groups can be found through the C-A Web page: www.rhichome.bnl.gov.

Memos and E-mail are used to communicate tasks that require action by employees. Effective communication requires that all C-A employees assure that the communication is understandable and clearly communicates the tasks that need to be accomplished, as well as the means (as required) and time frame in which they are to be accomplished.

Effective external communications regarding Collider-Accelerator EMS issues are essential to assure that the policies of the Laboratory as well as those of the Department are maintained to the highest standard. External communications may include correspondence with the following: regulators, DOE-BHG, suppliers, customers, civic groups, elected officials, general public, and the media. The primary means for official communications to these groups is through the Laboratory's Correspondence and Commitment Tracking System

(CCTS). The Chairman of the Collider-Accelerator Department appoints an individual responsible for the maintenance of CCTS within the department.

As part of official communications process, C-A Department Managers follow the Guidelines of OPM 1.10.3, Guidance on Community Involvement. Identifying whether or not an issue may need community involvement includes nine steps. C-A managers should complete the process for all issues and decisions that have any potential for interest or concern in the community.

External communications regarding EMS, which are informational in nature, may be posted on the C-A Web site: http://www.rhichome.bnl.gov/.

3.4.4 EMS Documentation

The core elements of this Environmental Management System and their implementation are described in this Program Description. In addition, Attachment 1.10.2.c, Collider-Accelerator EMS Document Flow-down Matrix details department level documents and records and their relation to Laboratory level documentation and the associated ISO requirement.

3.4.5 Document Control

The C-A document control system is developed in compliance with Laboratory requirements in the Internal Controlled Documents Subject Area. The following C-A procedures detail the generation, review, approval, and maintenance of all C-A documentation:

- C-A OPM 1.1 Authorization
- C-A OPM 1.2 C-A Documents
- C-A OPM 1.4 Document Control "Series" OPM's
- C-A OPM 13.4.1 Records Management Section

Review of EMS documentation is accomplished in accordance with the requirements of ISO 14001. Where review cycle of specific documentation is not specified in this standard, it is performed in accordance with C-A-OPM 1.1.

3.4.6 Operational Control

Operational Control requirements are satisfied through the administration of the Environmental Management Plans and Operational Control Forms as specified in the SBMS procedure, Identification of Significant Aspects and Impacts, or through the C-A Environmental Management Matrix of Objectives and Targets for Significant Aspects. It is the responsibility of the C-A Environmental Compliance Representative to establish and maintain Operational Control Forms so that they accurately reflect regulatory requirements and to ensure that processes, associated plans and controls are updated to satisfy the requirements of ISO 14001. Operational Controls are implemented by responsible persons as

identified on the form. Verification of implementation of controls and maintenance of EMS forms is performed by C-A Quality Assurance annually through its assessment of the C-A Environmental Management Program and by implementation of C-A OPM 13.10.1, Independent Assessment.

3.4.7 Emergency Preparedness and Response

The Collider Accelerator Department has an established emergency preparedness and response program. This plan is detailed in the OPM 3.0 "Series" of procedures and is intended to provide general guidance for use in responding to most incidents which may arise at the C-A Complex. This Local Emergency Plan supplements Laboratory Plan found in the Emergency Preparedness Subject Area, and makes provisions for emergency situations that are unique to the Collider Accelerator Complex. In addition to the Local Emergency Plan, specific procedural requirements for reporting and mitigating environmental impacts can be found in C-A-OPM 10.1, Occurrence Reporting and Processing of Operations Information, and C-A-OPM 10.2, Response to Tritiated Water Spills.

The C-A Department participates in the Laboratory's annual emergency response drill. At a minimum the Local Emergency Plan is reviewed annually.

3.5 Checking and Corrective Action

3.5.1 Monitoring and Measurement

Collider-Accelerator environmental performance monitoring is achieved through several programs. The C-A-OPM 13.10.1, Independent Assessment describes the overall monitoring of the C-A EMS program. Specific monitoring of environmental aspects is as outlined in the Operational Control Forms, and as specified in the associated OPM (where applicable) listed on the Operational Control Form. A listing of OPM procedures associated with Monitoring and Measurement can be found in Attachment 1.10.2.c.

3.5.2 Nonconformance, Corrective and Preventive Action

The C-A Department documents its environmental nonconformances, corrective, and preventive actions through three mechanisms. The primary means for documenting environmental nonconformances is through the Occurrence Reporting and Processing of Operations Information system. The OPM 10.0 series of procedures and the SBMS Subject Area on Occurrence Reporting and Processing System (ORPS), details the reporting, investigation, and closure of ORPS reportable events. The Final Report, submitted to the DOE, includes root cause analysis, corrective and preventive action. All environmental nonconformances, which are non-ORPS reportable occurrences, are documented using the SBMS Subject Area on Critiques or through the Subject Area, Nonconformance & Corrective and Preventive Action. Critiques may become part of a formal investigation of complex accidents/incidents and as such will be

reviewed against the Occurrence Reporting and Processing System (ORPS) subject area, for potential occurrence reporting.

3.5.3 Records Management

Records are managed by the C-A Department through the implementation of the Laboratory's Records Management Subject Area. The C-A Quality Assurance Department has further defined the Subject Area through C-A-OPM 13.4.1, entitled Records Management. In addition, the C-A Department has identified all significant operational, environmental safety & health, training, and quality records in C-A-OPM 13.4.2, Records Index.

3.5.4 EMS Audit

As part of the BNL Integrated Assessment Program the C-A Self Assessment Plan details the Department's response to the Laboratory's Critical Outcomes. The Self Assessment Process within the C-A Department encompasses planned assessments and compliance audits of the C-A EMS Program. Assessments and audits are used as the basis for examining, identifying and correcting weaknesses within the C-A EMS program to facilitate improved performance and compliance. The C-A Department's assessment process is defined in C-A-OPM 13.10.1, Independent Assessment. This document provides department-level assessment detail, which supplements various Subject Areas including Environmental Assessments.

Environmental Management System Audits are scheduled, performed and tracked through the Q.A. Assessments and Tracking Database. C-A EMS audits are conducted, at a minimum, annually. More frequent assessments may be performed on the basis of audit results, corrective action follow-up, as determined by criticality, process change, or as determined by C-A Management. Included as part of the Environmental Management System audit will be an assessment of regulatory compliance within the Department.

The scope of the annual EMS audit performed within the C-A Department shall be determined in conjunction with the scope of the Laboratory Level internal audit. Within these two audits the scope shall be structured to encompass an audit of all 17 ISO elements over a three-year period. The table listed below is given for general departmental guidance on structuring audits. The actual elements covered shall be determined by the C-A EMS team and shall be based on criticality of elements and in accordance with the SBMS.

Year 1	Year 2	Year 3
		Environmental Policy
Environmental Aspects	Environmental Aspects	Environmental Aspects
		Legal & Other Requirements
Objectives & Targets	Objectives & Targets	Objectives & Targets
Environmental Management Program	Environmental Management Program	Environmental Management Program
Structure & Responsibility		Structure & Responsibility
	Training, Awareness, & Competence	Training, Awareness, & Competence
Communication		Communication
	EMS Documentation	EMS Documentation
Document Control		Document Control
Operational Control	Operational Control	Operational Control
	Emergency Preparedness & Response	Emergency Preparedness & Response
Monitoring & Measurement	Monitoring & Measurement	Monitoring & Measurement
Nonconformance & Corrective and Preventive Action	Nonconformance & Corrective and Preventive Action	Nonconformance & Corrective and Preventive Action
Records		Records
	EMS Audit	EMS Audit
Management Review	Management Review	Management Review

3.6 Management Review

The Collider Accelerator Department, as a routine part of its operations, conducts various reviews at the senior management level. These meetings are held both weekly and monthly and are reflected in the flow diagrams and table found in C-A-OPM-ATT 2.28.a. Annually, and prior to ISO-14001 re-registration, the C-A Environmental Management Representative shall schedule a review of the C-A EMS Program with senior management as part of that month's senior management meeting. The agenda will accurately reflect the scope of the presentation. The management review will be accomplished in accordance with the provisions of the Subject Area, Preparing and Conducting Environmental Management Reviews. In addition, handouts will specifically address the environmental issues and copies of these handouts will be filed in the quality office. A formal Record of Decision will be documented and approved as a result of the Management Review. As appropriate, these documented decisions will be formally included in the EMS program for action.